CLAIMS

1. An optical pickup projecting a collected beam onto a recording surface of an optical storage medium to retrieve recorded information by means of an intensity of reflection from the recording surface, said pickup correcting a first spherical aberration in an optical system by producing at correcting means a second spherical aberration which cancels the first spherical aberration,

said pickup being characterized in that:

the correcting means is capable of producing at least two second spherical aberrations of different magnitudes by means of a collected beam spot on the recording surface of the optical storage medium so that the magnitudes are 1/4 or more of a wavelength λ in P-V values or 1/14 or more of a wavelength λ in standard deviation; and

said pickup comprises control means which: causes the correcting means to produce the at least two second spherical aberrations of different magnitudes; calculates an optimal magnitude of aberration correction for the first spherical aberration through a numeric evaluation based on an evaluation value of a reference signal obtained by receiving reflection of intensities in the presence of the spherical aberrations of such magnitudes; and controls the correcting means to carry out correction using the optimal magnitude of

aberration correction.

2. The optical pickup as set forth in claim 1, wherein

in the numeric evaluation, the control means calculates an approximation curve from the at least two second spherical aberrations of different magnitudes produced by the correcting means and the evaluation value for these second spherical aberrations and designates a peak or bottom position of the approximation curve as the optimal magnitude of aberration correction.

3. The optical pickup as set forth in claim 2, wherein

the approximation curve is a multiple term approximation curve.

4. The optical pickup as set forth in claim 1, wherein

the control means: causes the correcting means to produce the two second spherical aberrations of different magnitudes so that the two second spherical aberrations are separated by 1/2 or more of a wavelength λ in P-V values and that the second spherical aberrations have substantially equal evaluation values; calculates a mean value of the two magnitudes of the spherical aberrations as the numeric evaluation; and uses the mean value obtained in the mean value calculation as the optimal magnitude of aberration

correction.

5. The optical pickup as set forth in claim 1, wherein

the control means: causes the correcting means to produce a second spherical aberration of a first magnitude and a second spherical aberration of a second magnitude which is separated by 1/2 or more of a wavelength λ in P-V values from the second spherical aberration of the first magnitude so that the second spherical aberration of the second magnitude can produce a reference signal having an evaluation value substantially equal to that of a reference signal obtained in the production of the second spherical aberration of the first magnitude; calculates a mean value of the second spherical aberrations of the first and second magnitudes as the numeric evaluation; and uses the mean value obtained in the mean value calculation as the optimal magnitude of aberration correction.

6. The optical pickup as set forth in claim 1, wherein

the correcting means includes: a liquid crystal panel containing a circular band of transparent electrode provided on a liquid crystal layer filled with birefringent liquid crystal; and a liquid crystal drive circuit applying to the transparent electrode voltages corresponding to the at least two second spherical aberrations of different magnitudes.

7. The optical pickup as set forth in claim 1, wherein

the correcting means is a beam expander including a pair of lenses and capable of producing the second spherical aberrations by varying a distance between the lenses.

8. The optical pickup as set forth in claim 1, wherein

the correcting means is positioned on an optical path along which the beam projected onto the recording surface of the optical storage medium and the reflection from the recording surface travel.

9. The optical pickup as set forth in claim 1, wherein:

the control means: causes the correcting means to produce a second spherical aberration of a first magnitude and a second spherical aberration of a second magnitude so that the second spherical aberration of the second magnitude can produce a reference signal having an evaluation value substantially equal to that of a reference signal obtained in the production of the second spherical aberration of the first magnitude; calculates a mean value of the second spherical aberrations of the first and second magnitudes as the numeric evaluation; and uses the mean value obtained in the mean value calculation as the optimal magnitude of aberration correction; and

the first and second magnitudes are smaller than a maximum signal amplitude by 5% or more.

10. The optical pickup as set forth in claim 1, wherein:

prior to adjustment of a focus offset, the control means: causes the correcting means to produce a second spherical aberration of a first magnitude and a second spherical aberration of a second magnitude so that the second spherical aberration of the second magnitude can produce a reference signal having an evaluation value substantially equal to that of a reference signal obtained in the production of the second spherical aberration of the first magnitude; calculates a mean value of the second spherical aberrations of the first and second magnitudes as the numeric evaluation; and uses the mean value obtained in the mean value calculation as the optimal magnitude of aberration correction; and

the first and second magnitudes are smaller than a maximum signal amplitude by 10% or more.

11. The optical pickup as set forth in claim 1, wherein

the reference signal is an information signal read from the recording surface of the optical storage medium, and an evaluation value of the reference signal is an amplitude level.

12. The optical pickup as set forth in claim 1, wherein

the reference signal is a tracking error signal, and an evaluation value of the reference signal is an amplitude level.

13. The optical pickup as set forth in claim 1, wherein

the reference signal is an information signal, and an evaluation value of the reference signal is jitter.

14. The optical pickup as set forth in claim 1, wherein

the reference signal is an information signal, and an evaluation value of the reference signal is an error rate.

15. A method of correcting a spherical aberration of an optical pickup, said method correcting a first spherical aberration in an optical system by producing a second spherical aberration which cancels the first spherical aberration when the pickup projects a collected beam onto a recording surface of an optical storage medium to retrieve recorded information by means of an intensity of reflection from the recording surface, said method being characterized in that it comprises the steps of:

producing at least two second spherical aberrations of different magnitudes by means of a collected beam spot on the recording surface of the optical storage medium so that the magnitudes are 1/4 or more of a wavelength λ in P-V values or 1/14 or more of a wavelength λ in standard

deviation;

calculating an optimal magnitude of aberration correction for the first spherical aberration through a numeric evaluation based on an evaluation value of a reference signal obtained by receiving reflection of intensities in the presence of the spherical aberrations of such magnitudes; and

correcting the first spherical aberration using the optimal magnitude of aberration correction.

16. A method of correcting a spherical aberration focus offset of an optical pickup, said method correcting a spherical aberration and a focus offset in an optical system when the pickup projects a collected beam onto a recording surface of an optical storage medium to retrieve recorded information by means of an intensity of reflection from the recording surface, said method being characterized in that it comprises:

the step of recording a signal on the storage medium at a predetermined write power;

the step of reproducing the recorded information from the reflection;

the step of producing a first correction target in the presence of a predetermined second correction target and changing the first correction target, where the first correction target is either one of the focus offset and the spherical aberration, and the second correction target is the other one;

the optimal first correction target detection step of detecting an occurrence condition of the first correction target when the first correction target is a minimum;

the step of producing the second correction target under an occurrence condition of the minimum first correction target and changing a magnitude of the second correction target; and

the optimal second correction target detection step of detecting an occurrence condition of the second correction target when the second correction target is a minimum,

wherein the magnitude of the spherical aberration and the magnitude of the focus offset obtained in the first correction target detection step and the optimal second correction target detection step are used to correct the spherical aberration and the focus offset.

17. A method of correcting a spherical aberration focus offset of an optical pickup, said method correcting a spherical aberration and a focus offset in an optical system when the pickup projects a collected beam onto a recording surface of an optical storage medium to retrieve recorded information by means of an intensity of reflection from the recording surface, said method being characterized in that it comprises:

the step of recording a signal on the storage medium at a predetermined write power;

the step of reproducing the recorded information from the reflection;

the step of producing a spherical aberration in the presence of a predetermined focus offset and changing a magnitude of the spherical aberration;

the optimal spherical aberration detection step of detecting a spherical aberration occurrence condition when the spherical aberration is a minimum;

the step of producing a focus offset under the minimum spherical aberration occurrence condition and changing a magnitude of the focus offset; and

the optimal focus offset detection step of detecting a focus offset occurrence condition when the focus offset is a minimum,

wherein the magnitude of the spherical aberration and the magnitude of the focus offset obtained in the optimal spherical aberration detection step and the optimal focus offset detection step are used to correct the spherical aberration and the focus offset.

18. A method of correcting a spherical aberration focus offset of an optical pickup, said method correcting a spherical aberration and a focus offset in an optical system when the pickup projects a collected beam onto a recording surface of an optical storage medium to retrieve recorded information by

means of an intensity of reflection from the recording surface, said method being characterized in that it comprises:

the step of recording a signal on the storage medium at a predetermined write power;

the step of reproducing the recorded information from the reflection;

the step of producing a focus offset in the presence of a predetermined spherical aberration and changing a magnitude of the focus offset;

the optimal focus offset detection step of detecting a focus offset occurrence condition when the focus offset is a minimum;

the step of producing a spherical aberration under the minimum focus offset occurrence condition and changing a magnitude of the spherical aberration; and

the optimal spherical aberration detection step of detecting a spherical aberration occurrence condition when the spherical aberration is a minimum,

wherein the magnitude of the spherical aberration and the magnitude of the focus offset obtained in the optimal focus offset detection step and the optimal spherical aberration detection step are used to correct the spherical aberration and the focus offset.

19. The method as set forth in claim 16, wherein

a spherical aberration and/or a focus offset are produced which maximize an amplitude of the reproduced signal.

20. The method as set forth in claim 16, wherein

a spherical aberration and/or a focus offset are produced which minimize a jitter of the reproduced signal.

21. The method as set forth in claim 16, wherein

a spherical aberration and/or a focus offset are produced which minimize an error rate of the reproduced signal.

22. An optical pickup including a correction device producing a spherical aberration and a focus offset which cancel a spherical aberration and a focus offset in an optical system for correction when said pickup projects a collected beam onto a recording surface of an optical storage medium to retrieve recorded information by means of an intensity of reflection from the recording surface,

said pickup being characterized in that said correction device comprises:

recording condition detecting means detecting a recording condition recorded in advance on the optical storage medium;

test write means test-writing a predetermined signal in a test write area of the optical storage medium under the recording condition detected by the recording condition detecting means; and

correcting means executing: the process of producing a first correction target in the presence of a predetermined second correction target and changing the first correction target using a reproduction signal from the test write area, where the first correction target is either one of the focus offset and the spherical aberration, and the second correction target is the other one; the optimal first correction target detection process of detecting an occurrence condition of the first correction target when the first correction target is a minimum; the process of producing the second correction target under an occurrence condition of the minimum first correction target and changing a magnitude of the second correction target; the optimal second correction target detection process of detecting an occurrence condition of the second correction target when the second correction target is a minimum; and the process of using a magnitude of the spherical aberration and a magnitude of the focus offset obtained in the first correction target detection process and the optimal second correction target detection process to correct the spherical aberration and the focus offset.

23. The optical pickup as set forth in claim 22, wherein

the correcting means is a beam expander including a pair of lenses and matches a distance between the lenses to the magnitude of the spherical aberration obtained in the optimal spherical aberration detection process.

24. The optical pickup as set forth in claim 22, wherein

the correcting means includes: a liquid crystal panel containing a circular band of transparent electrode provided on a liquid crystal layer filled with birefringent liquid crystal; and a liquid crystal drive circuit applying to the transparent electrode voltages corresponding to the magnitude of the spherical aberration obtained in the optimal spherical aberration detection process.